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Discovering the Origin of Neutrino Masses at SHiP

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In $U(1)_R$ extensions of supersymmetric models, the bino and its Dirac partner, the singlino, can play the role of right-handed neutrinos. The bino and the singlino form a pseudo-dirac pair, dubbed the ‘ $b\nu o$ ’, which can generate Standard Model neutrino masses via the inverse seesaw mechanism. We investigate the prospects for detecting long-lived $b\nu o$ s at SHiP, where GeV scale $b\nu o$ s can be copiously produced in the decays of mesons. We show that SHiP can probe new regions of parameter space that are complementary to searches for the lepton flavor-violating decay $\mu \rightarrow e\gamma$. This scenario provides a well-motivated benchmark for future experiments of a right-handed neutrino that mixes with all Standard Model neutrinos, and is directly related to the generation of neutrino masses.

Primary authors: TUCKLER, Douglas; IPEK, Seyda

Presenter: TUCKLER, Douglas

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